HIBERNATION STUDIES OF THE POTATO LEAFHOPPER (*EMPOASCA FABAE* HARRIS) AND RELATED SPECIES OF EMPOASCA OCCURRING IN OHIO

By D. M. DeLong and J. S. Caldwell

Although textbooks and other published records of the biology of *E. fabae* indicate that this insect hibernates as an adult, to the best of our knowledge there are no authentic records or data for these conclusions. The senior author has already pointed out the fact that no positive data have been secured[1] and that all specimens which were secured under hibernating conditions and which have previously been thought to be *fabae* have been mistaken for other species where it has been possible to make identifications.[2]

In view of the manner of the appearance of this pest in the spring there are three possibilities which might be offered in explanation of the wintering condition. First, that the adult passes this period in hibernation; second, that it spends the winter in the egg stage upon a wild host plant and develops to maturity before migrating to economic food plants and, third, that it cannot live over winter in the northern states and migrates from southern areas in the spring. The evidence that has

[1]Jour. Eco. Ent. 24: 1220-1221, 1931.
[2]U.S.D.A. Bul. 231:2, 1931.

been obtained by field study and observations during the past eight years in support of each of these possibilities will be presented briefly.

In regard to the first possibility, adult hibernation, the evidence which has been obtained has all been negative. During the winters of 1926, 1927 and 1928 attempts were made to carry a large number of adult leafhoppers through the winter in hibernation quarters. Fallen leaves, crop remnants, and similar debris in protected places were used as a hibernation medium and not a single individual survived during these three seasons.

Beginning with 1927 attempts were made to find or recover *E. fabae* in hibernating quarters under natural conditions. To date these attempts have proven unsuccessful and all specimens of Empoasca that have been recovered in hibernation have proven to be some other species. *E. fabae* is by far the most abundant in numbers of any species of Empoasca occurring in the eastern U. S. and if it hibernates successfully under conditions similar to other hibernating leafhoppers, it should be found by chance at least, more quickly than any other species. But investigation has shown that *E. recurvata, infusca, birdii, curvata, bicorna, spira, hama, lata, recta, ditata, vergens, distracta, pyramidata* and one or two other species not yet described, all of which occur much less abundantly, have been found along with hibernating species of Erythroneura in Ohio during January, February, March and April but no specimens of *fabae* have been found either in these or similar habitats. Also if this insect passes the winter as an adult one would expect that it would come out of hibernation at approximately the same time as other hibernating leafhoppers such as species of Erythroneura, Dikraneura, Agellus, Agallia, Euscelis, Phlepsius, Thamnotettix, Platymetopius, Polyamia, Deltocephalus, and other species of Empoasca. However, observations have shown that the earliest specimens of *E. fabae* appear at least a month later than these hibernating species come out of winter quarters.

Several records have been published regarding the early occurrence of the adults of *E. fabae* upon wild host plants in the spring when they have supposedly come from hibernation. These observations and records have been made by investigators who have admitted that they did not use the genital characters to identify their material and could not distinguish *E. fabae* from the other species of Empoasca which are closely related, which have the same external appearance, and which normally live upon these wild hosts. Also an examination of specimens occurring in Ohio upon dock and other wild host plants in the spring has revealed the fact that all of them are specimens of *E. erigeron, E. bifurcata* or *E. recurvata*.

The earliest records of *E. fabae* for Columbus are late May although the real migration does not occur until about the middle of June. In 1933 for instance the first specimens found were taken on May 22 while the heaviest migration occurred on June 8 to 11. In 1932 the migration occurred on June 14 to 20.

The second possibility is that the insect overwinters in the egg stage upon a wild host plant and completes its development, then migrates to economic plants later in the spring. The time of its first appearance in the field would be a factor favoring this possibility. As indicated above,

it occurs in the field much later than hibernating material. But detailed search in the field during the early season for a period of eight years upon all types of wild host plants has failed to give any positive evidence that *E. fabae* winters in the egg stage upon these wild host plants. *E. erigeron* and *E. bifurcata* are known to pass the winter in this way and the eggs hatch in late April or early May. Although these species occur in very small numbers as compared to *E. fabae*, they are found commonly in the spring upon wild host plants in the nymphal stage, but nymphs of *fabae* cannot be found. If *E. fabae* overwinters as an egg, in view of its great abundance later in the season, it should be found easily early in the season in the nymphal stage either on wild or cultivated host plants. Examination of crop remnants has also failed to give any positive evidence regarding the overwintering as an egg.

In view of the fact that specimens of *E. fabae* cannot be successfully hibernated nor found in hibernation and that no evidence can be obtained regarding the passing of the winter in the egg stage upon either wild or cultivated host, and in view of the late appearance in the spring of the adults in great abundance, there is a strong possibility of the third explanation, that the insects pass the winter or survive only in areas of milder climate and migrate in Ohio and similar states as adults at a later date. The only evidence for this is the strong negative evidence presented in the other two possibilities and the fact that they appear in cultivated fields exactly as other migrating leafhoppers appear in other areas on economic crops. The migration flights are usually marked by the abrupt appearance of large numbers in cultivated fields and late in the season, apparently migrating from a breeding ground elsewhere.

Material taken in Florida and in the Gulf states show definitely that *E. fabae* breeds in these areas on alfalfa and similar crops during the winter and that the populations become quite large in March and April

Replying to queries, it was stated that in cold seasons, the insect appears first on alfalfa and then on potatoes, that it comes abundantly to trap lights, that it winters in the Gulf states and that there is no conclusive data for more northern sections.